CHAPTER 4
INSTALLATION OF TWGSS
LESSON PLAN 4

METHOD:

Conference, demonstration and practical exercise

TIME ALLOTTED:

3.0 hours

COURSE PRESENTED TO:

a. Tank crews
b. Instructors
c. TSC personnel

TOOLS, EQUIPMENT AND MATERIALS (Per Tank Crew):

a. M1/M1A1 tank with BII
b. One TWGSS set
c. TM 9-6920-709-12&P-1-1

PERSONNEL:

a. Primary instructor
b. Assistant instructor

INSTRUCTIONAL AIDS:

a. Overhead projector
b. Viewgraphs (Appendix C)

REFERENCES:

a. TM 9-6920-709-12&P-1-1, Chapter 2
b. TM 9-2350-255-10-1/2
c. TM 9-2350-264-10-1/2

APPENDICES:

Appendix A. Safety
Appendix B. Test Administration Guide
Appendix C. Viewgraphs

4-1. INTRODUCTION. (5 minutes)

Note. Show Slide 1.

a. **Reason.** TWGSS is designed for quick and easy installation. To use TWGSS to its full potential, you must be able to correctly and safely install the system on the tank.

Note. Show Slide 2.

b. **Training Objective.** Given an operational M1/M1A1 tank with BII, and with prepare-to- fire checks, boresighting, tank preparation, and TWGSS PMCS completed, the crew will properly install TWGSS IAW TM 9-6920-709-12&P-1-1, Chapter 2.

c. **Procedure.** During this block of instruction we will cover the installation of a TWGSS set in preparation for training. You will have an assistant (small group) instructor for the practical exercise portion of this class. After completion of training, you will be evaluated on your ability to install selected TWGSS components. You will use the appropriate TMs to install TWGSS.

4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE. (155 minutes)

Notes.
1. The primary instructor now releases the student crews to their assigned assistant (small group) instructor for the practical exercise portion of this lesson.
2. Prior to students' arrival, ensure that an assistant instructor is assigned to each training station.
3. Direct students to their appropriate training station.
4. Each assistant instructor is to conduct a safety briefing for his small group IAW Appendix A.
5. Whenever possible, have the student serve as demonstrators during small group instruction. Have one student read the procedures while another student performs the task. To ensure all students get equal hands-on time, rotate the reading and performance responsibilities.
6. The assistant instructor discusses and clarifies the procedures as required and reinforces the training objective.

Warning. Ensure that main gun is locked to turret roof, turret traverse lock is engaged, GTD switch is set to MANUAL, and vehicle master power switch is in OFF position prior to installation of TWGSS. Injury to personnel or damage to components could occur.

Note. Instructor reminds students of importance of having already completed prepare-to-fire checks, boresighting, tank preparation, and TWGSS PMCS.

a. **TWGSS Installation Tasks.** Working as a crew, you will install TWGSS on a M1/M1A1 tank IAW TM 9-6920-709-12&P-1-1. Installation tasks include:

(1) Installation of exterior components
(2) Installation of exterior cables
(3) Installation of interior components and cables
(4) Verification of installation

b. **Installation of Exterior Components.**

(1) **Transceiver unit for 105 mm gun (M1/M1IP).**

(a) Remove transceiver unit from 120 mm adapter by unlocking handle, rotating unit 45°, and pushing unit out through rear of adapter.
(b) Lift locking handle to unlocked position.
(c) Insert transceiver unit (laser lens up) into bore of gun.
(d) Insert transceiver unit into gun tube until recessed approximately 4-6 inches.
(e) Rotate transceiver unit until laser lens is aligned with the 12 o'clock witness mark of the barrel.
(f) Lock handle.

(2) **Transceiver unit for 120 mm gun (M1A1).**

(a) Insert transceiver unit into 120 mm adapter. This is done with locking handle inserted first through rear end of adapter.
(b) Perform steps 1(b) through 1(f) above.

Note. For M1 tank the TBOS driver assembly is installed even if TBOS GAS assembly is not.

(3) **TBOS driver assembly.**

(a) Lift locking handle on TBOS driver assembly. Open bracket.
(b) Position TBOS driver assembly under top bracket located on gun mantle, flush with mantle, electrical connectors toward right side. Close bracket.
(c) Push locking handle down to lock.

(4) **TBOS GAS assembly (M1IP/M1A1).**

Caution. Before installing TBOS GAS assembly ensure that GAS optical port is clean. Dirt and debris could damage the TBOS GAS assembly.

Note. The locking nut uses a 13 mm wrench found in tank BII.

(a) Loosen TBOS GAS assembly locking nut.
(b) Position TBOS GAS assembly in GAS optical port.
(c) Tighten mounting bracket locking nut with open end wrench.

4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).

(5) **Retro detector assembly (right- and left-front).**

(a) Lift locking handle.
(b) Position retro detector assembly inside right/left upper bustle rack railing forward of sponson box.
(c) Push locking handle down to lock.

(6) **Hull defilade detector unit (right- and left-front).**

(a) Position unit in front of right/left tow cable brush deflector.
(b) Ensure metal edge of unit is positioned underneath turret edge

Notes. 1. The hull defilade detector unit cable uses a push/pull type connector, not the MIL-STD connectors found on the tank.
2. Demonstrate to the crew how to connect and disconnect the push/pull connector.

(c) Route and connect cable labeled J2 to retro detector unit connector J2.

(7) **Target computer assembly.**

(a) Lift locking handle.
(b) Position target computer assembly on inside of right-rear bustle rack railing, with connectors toward rear of tank.
(c) Push locking handle down to lock.

(8) **Retro detector assembly (right- and left-rear).**

(a) Lift locking handle.
(b) Position retro detector assembly into right/left rear turret bustle rack upper and lower railings against outside of outermost vertical bar.
(c) Push locking handle down to lock.

(9) **Remote System Interface (RSI) Assembly.**

(a) Lift locking handle.
(b) Position RSI assembly on inside of left-rear bustle rack railing, with connectors toward rear of tank.
(c) Push locking handle down to lock.

4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).

c. **Installation of Exterior Cables.**

(1) **W1 cable.**

Notes. 1. Unlike tank cables, W1 cable connectors use a push/pull connector.
2. Demonstrate to the crew how to connect and disconnect push/pull connector.
3. Ensure cable dust cap does not obstruct transceiver unit field of view.

(a) Connect cable end marked J1 to transceiver unit connector J1.
(b) Route cable along main gun at 11 o'clock position, attach cable with Velcro straps (evenly spaced).
(c) Connect cable end marked J2 to TBOS driver unit J2.

(2) **W7 cable (M1IP/ M1A1).**

Notes. 1. Unlike tank cables, W7 cable connectors use a push/pull connector.
2. Ensure W7 cable does not interfere with TBOS GAS assembly field of view.

(a) Connect cable end marked J1 to TBOS GAS unit connector J1.
(b) Route cable up right side of main gun. Secure with velcro straps.
(c) Connect cable end marked J3 to TBOS driver unit connector J3.

(3) **W2 cable.**

Note. Unlike tank cables, W2 cable connectors use a push/pull connector.

(a) Connect cable end marked J1 to TBOS driver unit connector J1. Close protective bag of TBOS driver assembly.
(b) Route cable up over turret (attach with magnets), behind GPS, to right side sponson box. Continue along box to target computer unit.
(c) Connect cable end marked J2 to target computer unit connector J2.

(4) **W12 cable.**

(a) Connect W12 cable connector J1 to target computer unit connector J1.
(b) Route W12 cable along inside middle of bustle rack to RSI assembly.
(c) Connect W12 cable connector J2 to RSI connector J2.

(5) **W5 cable.**

(a) Connect cable end marked J3 to target computer unit connector J3.

4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).

Note. Unlike tank cables, W5 cable connector J1 uses a push/pull type connector.

(b) Route shorter end of W5 cable, connector J1 along turret bustle rack railing to right-rear retro detector assembly and connect to retro detector unit connector J1.
(c) Route longer end of W5 cable, connector J1, along sponson box to right- front retro detector assembly and connect to retro detector unit connector J1.

(6) **W6 cable.**

(a) Connect cable end marked J4 to target computer unit connector J4.

Note. Unlike tank cables, W6 cable connector J1 uses a push/pull connector.

(b) Route shorter end of W6 cable, connector J1 along turret bustle rack railing to left-rear retro detector assembly and connect to retro detector unit connector J1.
(c) Route longer end of W6 cable, connector J1 along sponson box to left- front retro detector assembly and connect to retro detector unit connector J1.
(d) Close target computer unit protective bag.

(7) **W3 cable.**

Note. Unlike tank cables, W3 cable connectors use push/pull connectors.

(a) Connect cable end marked J1 to RSI unit connector J1. Close protective bag of RSI unit.
(b) Route cable along inside of turret bustle rack railing to left sponson box.
(c) Insert grommet into loader's hatch periscope mount. Secure with periscope retaining screws.
(d) Route cable from left sponson box into grommet. Leave cable for later connection.

Caution. Improper positioning of magnets or improper W3 cable routing can result in damage to W3 cable.

(e) Attach one magnet on outside of loader's hatch as close to hinge as possible.

Note. Rotate periscope in order to position cable magnets as close to hinge as possible.

(f) Attach one magnet on inside of loader's hatch as close to hinge as possible.
(g) Open and close hatch to ensure hatch can be operated without damage to W3 cable.

(h) Leave other end of W3 for later connection.
(i) Secure cables with velcro straps.

d. **Installation of Interior Components and Cables.**

Caution. Do NOT use force when connecting or disconnecting cables.

(1) **Turret position sensor.**

(a) Lift locking handle to unlocked position.
(b) Attach turret position sensor to floor support beam. Ensure drive gear of sensor meshes with turret ring gear.
(c) Lower locking handle to lock.

(2) **Loader's panel.**

Attach loader's panel to turret support beam between ammo doors, facing loader's position.

(3) **Vehicle interface assembly.**

(a) Position vehicle interface assembly close to .50 cal. ammo box inside tank.
(b) Ensure all cables in vehicle interface assembly are connected.
(c) Connect W3 cable connector J2 to TBOS video mixer unit connector J2.
(d) Connect control panel cable connector J1 to vehicle interface unit connec-tor J1.
(e) Insert vehicle interface assembly into .50 cal. ammo box.
(f) Secure vehicle interface assembly with two retaining screws.

(4) **W10 cable leading to loader's panel.**

(a) Route cable bundle to turret roof support beam. Secure cable bundle with velcro strap.

Note. W10 cable radio connections will be made later.

(b) Connect W10 cable connector J1 to loader's panel connector J1.
(c) Locate W10 cable connector marked turret position sensor J1 and W8 cable connector marked TBOS junction box J3.
(d) Route cables along turret behind the commander's position to the TPS. Connect W10 cable connector J1 to TPS connector J1.
(e) Route W8 cable marked junction box J1 from TPS behind CCP to TIS.

4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).

(5) **TBOS junction box.**

Caution. When connecting or disconnecting tank cables use extreme care. If you have not been trained in the following task, notify your immediate supervisor for assistance.

(a) Disconnect cable connector J2 from Thermal Imaging System (TIS) Image Control Unit (ICU) panel.
(b) Connect cable from TIS control panel J2 to TBOS junction box connector J1.
(c) Connect W8 cable connector J3 to TBOS junction box connector J3.
(d) Connect TBOS junction box connector J2 to TIS control panel connector J2.
(e) Secure cables with velcro straps.

(6) **W10 cable connections to radio (1780).**

Caution. Ensure cables are routed to avoid damage when ammunition door is operated.

(a) Route cable at loader's panel along turret roof toward radio.
(b) Connect leads labeled AUDIO INPUT and AUDIO GROUND to amplifier terminals. Strap cables while routing them.
(c) Attach grounding wire to radio's lower left mounting bolt.

(7) **W9 and W11 cable routing to TNB.**

Caution. Ensure cables are routed to avoid damage when ammunition door is operated.

(a) Connect W11 cable connector J2 to loader's panel connector J2.
(b) Route W9 and W11 cables over ammunition door, along left side of turret to the TNB. Strap cables while routing them.

Note. TNB connectors TEST1 and TEST2 are keyed at 1 o'clock.

(c) Connect W 11 connector marked TNB TEST1 to TNB connector TEST1.
(d) Connect W11 connector marked TNB TEST2 to TNB connector TEST2.

Caution. Do NOT connect cable labeled W9 Utility Outlet. This connector applies power to TWGSS and is the last cable connected within the system.

(e) Leave W9 cable for later connection to TNB.

4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).

Warning. Ensure that main gun is locked to turret roof, turret traverse lock is engaged, GTD switch is set to MANUAL, and vehicle master power switch is in OFF position prior to performing the following steps.

(8) **W11 cable routing to CEU and LOS.**

Warning. If cables are routed improperly, elevation/depression of main gun could cut cables and result in gun/turret rotation. Before continuing with installation verify cable routing.

Note. Step (a) is performed for M1A1 only.

(a) Route W11 cable connectors, labeled CEU J2, CEU J3, and LOS TJ3 on left side of TNB, along floor between loader's oddment box and electronics rack, to CEU and LOS units.

Warning. If cables are routed improperly, elevation/depression of main gun could cut cables and result in gun/turret rotation. Before continuing with installation verify cable routing.

Note. Step (b) is performed for M1 only.

(b) Route W11 cable connectors labeled CEU J2, CEU J3, and LOS TJ3 along floor past the three round ammunition rack. Make sure cables are protected by cable channel. Route cables up toward CEU and LOS units after cables pass the three round ammunition rack.

Warning. Cables could be connected improperly, resulting in uncontrolled gun/turret movement causing injury or death. Cables are marked to avoid improper connection.

Caution. When connecting or disconnecting tank cables use extreme caution. If you have not been trained in the following task, notify your immediate supervisor for assistance.

Note. LOS connector TJ3 is keyed at 9 o'clock.

(c) Connect W11 cable connector LOS TJ3 to LOS connector TJ3 .
(d) Disconnect tank cable marked 1W202-9P1 from CEU connector J3.
(e) Connect removed tank cable to connector P1 of W11 circuit box.
(f) Disconnect tank cable marked 1W202-9P2 from CEU connector J2.
(g) Connect removed tank cable to connector P2 of W11 circuit box.

Note. CEU connector J2 is keyed at 12 o'clock.

(h) Connect W11 cable connector J2 to CEU connector J2.

Note. Connector CEU J3 is keyed at 12 o'clock.

(i) Connect W11 cable connector J3 to CEU connector J3.
(j) Install turret electronics shield under main gun.

Warning. Ensure ITGS (Hoffman device) is clear of pyrotechnical charges.

(9) **Connection to ITGS (Hoffman Device).**

(a) Connect W9 connector Hoffman ground to ITGS cable labeled (Hoffman) ground.
(b) Connect W9 connector Hoffman power to ITGS cable labeled (Hoffman) power.
(c) Connect W11 connector Hoffman trigger to ITGS cable labeled (Hoffman) trigger.

(10) **W9 power cable connection.** Connect W9 power cable connector J1 to utility connector UJ1 on TNB.

e. **Verification of Installation.**

Warning. Ensure ALL cables between tank and TWGSS are properly connected before turning on vehicle master power switch. Improperly connected cables may cause uncontrolled gun/turret rotation causing injury or death.

(1) Verify that all units are properly installed.
(2) Check that all cables are secured with velcro straps.
(3) Check that cables are routed without loose ends and with enough slack to allow gun and turret movement.
(4) Elevate and depress gun manually to verify that no internal or external cables or assemblies can be damaged.
(5) Rotate turret manually to verify that no internal or external cables or assemblies can be damaged.
(6) Check cable routing to ensure that no cables interfere with hatch operations.
(7) Check ammo storage door to ensure that cables will not be pinched or otherwise damaged during operation of door.
(8) Ensure all on-board equipment is stored to prevent damage to cables and assemblies.
(9) Check cable routing for potential trip hazards.
(10) Set gun/turret drive (GTD) switch in MANUAL position.
(11) Switch on vehicle master power.
(12) Switch on turret power.

4-2. CONFERENCE/DEMONSTRATION/PRACTICAL EXERCISE (Con't).

Warning. If the tank FCS indicates a malfunction, immediately turn off turret and vehicle master power. Troubleshoot IAW TM 9-6920-709-12&P-1-1, Chapters 3 and 4.

(13) Verify that an FCS MALFUNCTION is not indicated.
(14) Set FCS mode switch to NORMAL position.

Warning. If uncontrolled gun/turret movement occurs, immediately release palm switch and switch off turret power and vehicle master power. Troubleshoot IAW TM 9-6920-709-12&P-1-1, Chapters 3 and 4.

(15) With deck of tank and area around tank clear of personnel and equipment, have gunner grasp and release palm switch to ensure that no uncontrolled gun/turret movement occurs.

4-3. TEST. (15 minutes/test)

Note. See Appendix B.

4-4. FINAL REVIEW. (5 minutes)

a. **Student Questions.**

Note. Show Slide 3.

b. **Summary of Main Teaching Points.**

(1) Installation of exterior components
(2) Installation of exterior cables
(3) Installation of interior components and cables
(4) Verification of installation

Note. Show Slide 4.

c. **Closing Statement.** This block of instruction has taught you how to properly and safely install TWGSS on an M1/M1A1 tank.

APPENDIX A
TO LESSON PLAN 4

INSTALLATION OF TWGSS

SAFETY

Listed general safety regulations are to be strictly enforced during the performance of this lesson.

1. Mount and dismount tank over left front fender.
2. Maintain three points of contact while on top of tank.
3. No smoking within 50 m of tank.
4. Do not go over or under gun tube.
5. Ensure LRF has eye-safe laser filter (ELF) installed and LRF is set to SAFE.
6. LASER SAFETY: Do not view transceiver unit with optics from a distance of 25 m or closer.
7. Ensure gun/turret drive (GTD) switch is set to MANUAL position during installation and before leaving turret.
8. Ensure vehicle master power switch is in OFF position during installation.
9. Ensure turret power switch is in OFF position during installation.
10. Ensure TNB utility power switch is in OFF position during installation.
11. No cables should be connected or disconnected by untrained personnel.
12. Extra care should be taken when power is switched on after TWGSS installation. This is to ensure integration to FCS is correct and secure.

APPENDIX B
TO LESSON PLAN 4

INSTALLATION OF TWGSS

TEST ADMINISTRATION GUIDE

B-1. TASK.

Administer test, *Installation of TWGSS W11 Cable*.

B-2. CONDITIONS.

Given a fully operational M1/M1A1 tank with TWGSS installed except for W11 cable.

B-3. STANDARDS.

The crewman will correctly install the W11 cable within 10 minutes.

B-4. PERSONNEL, EQUIPMENT, AND MATERIAL REQUIRED.

a. Evaluator (one per test station)
b. TWGSS set (one per evaluator)
c. M1/M1A1 tank with BII (one per evaluator)
d. TM 9-2350-255-10-1/2 or TM 9-2350-264-10-1/2 (one set per test station)
e. TM 9-6920-709-12&P-1-1 (one copy per test station)
f. Scoring checklist of Appendix B (one copy for each crewman tested)

B-5. TEST PLANNING TIME.

Administrative time:	5 minutes
Test time:	10 minutes
TOTAL TIME (per crewman):	15 minutes

B-6. OTHER INFORMATION.

Before the crewman arrives, the evaluator will:

a. Install TWGSS, except for W11 cable, IAW TM 9-6920-709-12&P-1-1, Chapter 2.
b. Ensure CEU protective guard is removed from underneath the gun.
c. Have W11 cable ready for crewman to install.
d. Ensure TM 9-2350-255-10-1/2 or TM 9-2350-264-10-1/2 is available.
e. Ensure TM 9-6920-709-12&P-1-1 is available.
f. Have scoring checklist ready for crewman to be tested.

B-7. INSTRUCTIONS TO STUDENT.

" The purpose of this test is to determine your ability observe safety regulations and to correctly install the most critical component of TWGSS to the M1/M1A1 tank. You will have 10 minutes to complete all steps. You must complete each step before beginning the next step. Your time will start when I announce ‘BEGIN’ and end when you announce ‘FINISHED’. You may use TM 9-6920-709-12&P-1-1 during the test".

“Do you understand the requirements of this test?” (Answer questions)
“You may begin.” (Start time)

INSTALLATION OF TWGSS W11 CABLE

Scoring Checklist

NAME _____ UNIT _____

GRADE _____ DUTY POSITION _____

	GO	NO GO
1. Did the soldier observe safety regulations prior to installation?	_____	_____
a. Vehicle master power switch set to OFF position	_____	_____
b. Turret power switch set to OFF position	_____	_____
c. Gun locked to turret roof	_____	_____
d. Turret traverse lock engaged	_____	_____
e. GTD switch set to MANUAL	_____	_____
2. W11 cable installation		
a. W11 cable connection to loader's panel	_____	_____
b. W11 cable routing to TNB	_____	_____
c. W11 cable connection to TNB TEST1	_____	_____
d. W11 cable connection to TNB TEST2	_____	_____
e. W11 cable routing to LOS TJ3	_____	_____
f. W11 cable connection to LOS TJ3	_____	_____
g. CEU J2 tank cable connection to W11 cable	_____	_____
h. CEU J3 tank cable connection to W11 cable	_____	_____
i. W11 cable connection to CEU J3	_____	_____
j. W11 cable connection to CEU J2	_____	_____

	GO	NO GO
3. Did the soldier observe safety regulations during installation?	_____	_____

	GO	NO GO	INITIALS
Soldier satisfactorily completed all requirements?	_____	_____	_____

EVALUATOR _____ DATE _____

REMARKS _____

APPENDIX C
TO LESSON PLAN 4

INSTALLATION OF TWGSS

VIEWGRAPHS